SCIENCE

FRIDAY, MAY 1, 1914

CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y

THE STUDY OF HUMAN BEHAVIOR[1]

MY part in this symposium must be that of the comparative psychologist who, while professionally engaged in the experimental study of the behavior of lower organisms, is keenly interested in human behavior and in the development of methods by which it may be profitably studied. I propose, in this discussion, to try to bring some of the experiences of the student of the behavior of animals to bear upon the problems which the eugenic investigator meets. Especially I shall attempt to indicate the necessity for an analytic procedure on the basis of carefully wrought out methods of experimental control and observation, and the thorough-going study of the components of human responses to situations rather than of complexes such as are actually presented to us in the behavior of human beings.

Human behavior is only a part, albeit a most important part, of the materials of the general science of organic behavior. It presents essentially the same kinds of problems as does the behavior of any other mammal; and it must be studied by methods similar to, if not actually identical with, those employed by the student of infra-human behavior. I should be in-

[1] The substance of the writer's contribution to a symposium on the Study of Human Behavior at the Conference on Eugenics, held at Cold Spring Harbor, Long Island, June 19 and 20, 1913. Being Contributions from the Psychopathic Hospital, Boston, Massachusetts, No. 25 (1913. 25): previous Contribution, P. H. Contributions 1913. 24, was Robert M. Yerkes: "Comparative Psychology: A Question of Definitions." *The Journal of Philosophy, Psychology and Scientific Methods,* October 9, 1913.

clined to go still further in maintaining that a student of comparative psychology, or the behaviorist in the wide sense, is admirably fitted, by his experience in dealing with varied forms of behavior, by his knowledge of the genetic relations or developmental history of organic behavior, and by the ingenuity in devising and using experimental methods which his work forces him to acquire, to formulate problems in human behavior and to suggest methods of solving them.

There are at least three valuable points of view from which the behavior of man may be studied: the psychological; the physiological; and the pragmatological.[2] The first inclines the observer to an analytic study of activity in its relations to the ideas, motives, purposes and ideals of the organism; in a word, to a study whose goal is the description of behavior as an expression of will. The second disposes the investigator to seek definite knowledge of the functions of motor organs and of the relations of those mechanisms to other bodily organs and processes. From this point of view, the organism is studied as a living thing, influenced by environment and reacting upon it. The third directs him to the products of organic activity, as keys to the meaning of conscious behavior. It may reasonably be maintained that the understanding of the behavior of any organism, and most of all that of man, is conditioned by reliable and reasonably complete knowledge of the experiences of the organism, of its life processes, including its complex as well as its simple forms of behavior, and of the products or results of its bodily activities. We may consider fortunate those students of human behavior who are able to take, in turn, as occasion demands or as opportunity makes possible, these three points of view, for we must recognize that man is a self-conscious being who exhibits varied and complex activities and at the same time produces works of science, industry and art which are of deep psychological significance. This, however, is merely equivalent to the statement that human behavior may be clearly understood only if viewed in its relations, on the one hand, to its structural conditions, and on the other, to its purposes and results.

The history of science indicates that man has been surprisingly slow to come into close quarters, in a strictly scientific manner, with his own behavior. Of psychological, neurological, ethnological and archeological facts we to-day have an abundance. But we know relatively little concerning the facts and laws of human activity. This is true, I believe, chiefly for two reasons. First, because consciousness, presenting as it does a perennially puzzling problem in its relations to body, has absorbed attention; and, second, because the results of human behavior have proved more engaging to most observers, even to most scientific observers, than the behavior itself. To-day, a change is evident, for here and there "human behavior" has become an object of scientific interest. Sometimes this interest is inspired by practical problems; sometimes, by the desire for scientific knowledge. Recently, there have appeared several books[3] which, although dealing with

[2] We lack a term to designate the point of view of the scientific student of the results or products of activity, such, for example, as the abodes of animals or of man, works of art, scientific inventions, etc. I have designated this point of view as pragmatological, in the absence of a more suitable term.

[3] Among these may be mentioned "The Science of Human Behavior: Biological and Psychological Foundations," by Maurice Parmelee, New York, 1913; "The Fundamental Laws of Human Behavior; lectures on the foundations of any mental or social science," by Max Meyer, Boston, 1911; "Introduction to Social Psychology," by William McDougall, London, 1908.

the general subject of man's behavior, are indicative rather of the realization of the need of knowledge than of the existence of such knowledge. Without exception, such general discussions as the writer is familiar with display our ignorance of the facts of behavior and of the principles underlying them and serve rather as arguments in favor of the systematic study of this group of phenomena than as satisfactory treatises.

The behaviorist, whether he be physiologist or psychologist at heart, seeks, first of all, accurate knowledge of the facts of behavior. His task it is to analyze behavior-complexes, to discover their conditions or causes, to formulate the laws of their appearance, and to point the way to their control. It matters not to him whether his subject happens to be a horse, an ape, or a man. He adapts his methods of investigation to the problem and the subject in hand and proceeds to gather data. It is characteristic of the recent experimental work in behavior that reactions to simple or complex situations should be broken up into smaller and smaller part processes, and the characteristics of these processes as well as their relations, studied minutely, persistently, accurately.

Our time-honored classification of activities as reflex, instinctive, impulsive, habitual, voluntary, is no longer in favor. Indeed, the speculative discussion of the characteristics of different types of activity and attempts to formulate definitions which shall render these types mutually exclusive have to-day given place to systematic searching for the characteristics or attributes of acts and groups of acts, and for genetic descriptions thereof. Only recently, it must be confessed, have we fully realized that an instinctive act is something to be observed and reobserved under varied and rigidly controlled conditions; something to be studied in its origin and development; something to be created, if possible, by the control of conditions of organic behavior, rather than something merely to be talked about or defined in abstract terms. The older literature of instinct is vague, general, speculative. The newer is definite, concrete, observational. And what is true of our studies of instinct is true, likewise, of our studies of the various senses and of habits.

It is rather late in this discussion to define behavior, yet an attempt to do so may serve to correct certain misimpressions which seem not uncommon. The term, as used by the scientist to-day, is inclusive not merely of those gross and obvious activities exhibited by man in common with the other animals, but of hidden organic processes. The behaviorist is interested quite as much in reflexes, which might ordinarily be relegated to physiology, as in habitual, or instinctive, or voluntary acts. But he is interested, also, as much in the complex forms of behavior, known as conduct, as in the simpler expressions of human intelligence. Indeed, even the most complex moral and religious forms of activity are regarded by him as material for scientific study.

A strictly scientific study of the varieties of human behavior demands, first, the formulation of problems, for advance comes slowly and uncertainly unless the investigator can definitely formulate his task. It demands, further, thorough knowledge of the methods of physiology, of psychology, of physics, and of chemistry, and ingenuity on the part of the experimenter in adapting these methods to his immediate needs. Finally, it demands familiarity with the facts of behavior in other organisms, in order that the comparative method may be made to lend abundant aid.

Noteworthy changes have occurred in the study of behavior during the past twenty

years. Then, observation was naturalistic, general: now, it is experimental, specific. Most obvious and most important of the changes is the development of methods by which the conditions of observation may be controlled and the results precisely recorded. The older work was, on the whole, crude, inconclusive, wasteful of time, leading to few safe generalizations; the newer, by contrast, is precise, carefully controlled, and tending to lead to the formulation of laws. It is, of course, desirable that we recognize that not all observation can be conducted under experimental conditions, that the naturalistic method in the study of human behavior as also in the study of animal behavior has its proper and important place. We should gladly recognize its values, while insisting upon the importance of supplementing it by the experimental study of the same phenomena.

But the practical-minded person has doubtless been asking, throughout this introductory discussion, of our topic, "How may the reactions of a person be scientifically studied? Is it possible, ordinarily, to subject a human being to such conditions of observation as are used in experiments with other animals?" A few examples from studies of human and infra-human behavior will serve as an answer to these questions.

One of the most interesting aspects of organic activity is its modifiability. We designate this as habit-formation. Now, it happens that in a great variety of organisms the formation of habits has been studied experimentally. In the case of the dancing mouse,[4] for example, I investigated the relation of rapidity of habit-formation to certain external conditions. With an apparatus so arranged that the mouse could choose as its route through the experiment box either a dark or a light passageway, I determined the number of experiences necessary in order that the animal should learn that, no matter what the spacial relations of the passageways, only the light one could safely be chosen as a way of egress, since each time the dark passageway was entered a disagreeable electric shock resulted. It was the problem of the observer to discover how quickly, under a given set of conditions, the mouse would learn always to avoid the one passageway and to seek the other. In this experiment, which was so conducted that strictly comparable results were obtained from several individuals, it was first ascertained that the less the difference in lightness of the two passageways, the longer it took the mouse to learn to choose correctly. Next, it was determined that the rapidity of learning varied with the strength of the electric shock, which was regularly given as punishment for mistakes. When the passageways differed markedly (discrimination easy), the stronger the shock the more rapid the learning. When the passageways differed slightly (discrimination difficult), beyond a certain point, increase in the strength of the shock delayed the learning process. When the passageways differed by an intermediate amount, it appeared that an intermediate strength of stimulus was most favorable to habit-formation. From these observations, it was possible to deduce the following law for the behavior of the dancing mouse: As the difficultness of visual discrimination increases, that strength of electric stimulus which is most favorable as a condition for the acquisition of a habit tends to approach the threshold.

In this investigation, we have, first, a definite problem; second, a reasonably large number of observational data (facts of be-

[4] Yerkes, Robert M. and Dodson, John D., "The Relation of Strength of Stimulus to Rapidity of Habit-formation," *Journal of Comparative Neurology and Psychology*, 1908, Vol. 18, p. 459.

havior), and, third, a law of behavior for the particular organism in question. In effect, what I did with the dancing mouse might be done with human subjects, should it seem desirable to gain definite knowledge of this aspect of habit-formation. As it happens, precisely the kind of knowledge of human behavior which such experimental methods yield is necessary, if we are ever to have a thoroughgoing science of human behavior which will enable us to deal with our fellows effectively.

Another illustration may be taken from the study of imitative activity. It is generally recognized that imitation may be studied experimentally in any organism. But up to the present most observations of this group of phenomena have been casual, and our opinions concerning the importance of imitation in any organism are quite likely to be based upon insufficient or inaccurate information. With sparrows, canaries, mice, rats, cats, dogs, monkeys, experiments have been made to determine the nature and extent of imitative reaction, and there is no obvious reason why the methods of the behaviorists should not be adapted to the study of the imitative tendency in human beings.

In order to exhibit, in its general features, a method of studying imitation experimentally, we shall consider investigations of this aspect of behavior in monkeys.[5] The observer, first of all, seeks for a number of acts or series of acts which his animals either can not learn to perform of their own initiative or learn with extreme difficulty. Such acts are most readily discovered in connection with artificially arranged situations, as, for example, in connection with puzzle or problem boxes and similar experimental devices. He then teaches one animal to perform an act and thereafter, under definitely describable and constant conditions, he permits another animal to observe the behavior of the first. Any tendency for the second animal to imitate the first, or to modify its behavior in accordance with the activities of the first, is noted. Thus, by repetition after repetition of this sort of experiment, the observer strives to get definite knowledge of the nature and extent to which the behavior of one animal influences that of its fellows. It is, of course, necessary in such an experiment to work out a method carefully and to make all observations under carefully controlled conditions. It is necessary, also, to measure as precisely as possible several aspects of the behavior of the observing individual, and thus to depend not upon general impressions, but upon records which can not be influenced by any bias on the part of the experimenter.

Such experimental studies as those of Watson and Haggerty have proved that certain monkeys imitate much less generally than is commonly supposed. And further, that they imitate seldom, if ever, in the purposive manner in which man imitates. It seems that although they influence one another markedly in their behavior, this influence is chiefly a matter of the directing of attention. The imitation of means or of ends in a voluntary and wholly conscious manner rarely appears among the mammals below man.

An illustration from actual experimental work which clearly indicates the need of analyzing behavior complexes and of dealing quantitatively with simple bits of behavior is furnished by some recent work which the writer has done with rats. It was his task to try to discover the modes of heredity of savageness and wildness in rats.

[5] Haggerty, M. E., "Imitation in Monkeys," *Journal of Comparative Neurology and Psychology*, 1909, Vol. 19, p. 337; Watson, B., "Imitation in Monkeys," *Psychological Bulletin*, 1908, Vol. 5, p. 169.

In order to accomplish this task, it was necessary to analyze savageness and wildness. This meant discovering those acts or organic processes which, taken together, mean to the observer savageness or wildness. The first result of observation was that biting, squealing, struggling to escape, or attacking the experimenter, and process of excretion, appeared as important elements of savageness. The experimenter, relying upon these elements, measured, roughly, the savageness of a large number of individuals, arranging them according to their behavior in six grades, designated 0 to 5. On the basis of this obviously crude preliminary work, certain facts indicative of the mode of transmission of savageness and wildness were ascertained.[6]

In yet other observations on rats which involved the comparison of two groups, stock individuals and closely inbred individuals, it appeared that the behavior of the two groups, in the face of certain experimentally arranged situations, differed greatly. This, upon careful observation, the experimenter was able to attribute to differences in temperament. The stock rats were rather active, energetic, quick moving, whereas the inbred animals were more stolid, slow and deliberate. In order that the reactions of these individuals in various experimental situations be properly interpreted, it is essential that the experimenter obtain knowledge of their temperamental character, such, for example, as degree of nervousness or of timidity, of savageness or wildness, quickness of response, persistence, energy and so on through the list of aspects of behavior which, looked at as a whole, might be considered the temperament of the animal. The point which I am trying to emphasize is this. If we are to work effectively, with human beings or other animals, we must analyze the concrete behavior of the organism's every-day life into simpler processes and then study these processes, one by one, by means of methods which shall enable us to measure them fairly accurately and describe them with corresponding accuracy and precision.

The application of these observations in the work of the eugenics investigator are obvious, for the latter, in dealing with human behavior, first of all observes complexes. If he is content to continue to observe these complexes and to try to study their behavior in heredity, he may or may not obtain scientifically valuable results. But in any event, his safer course by far is to deal with part processes, first to analyze his complexes and then to select what seem to be the most important elements and carefully study their characteristics and their behavior as possible inheritances. From his own experience, the writer is inclined to urge that it is always safer to deal with items of behavior than to attempt to deal with behavior in a large or wholesale manner—safer, for example, to study capacity for a particular sort of musical expression, singing or violin playing, than to study musical ability in general.

Were we to present more examples from actual work, we might describe methods of studying distance orientation, visual discrimination, other aspects of habit-formation, the permanency of habits, instinct and emotion, in animals, but it will suffice for our present purposes to describe briefly two methods of analyzing behavior which have recently been devised. These methods, unlike those in general use by students of animal behavior, are applicable alike to man and to other mammals, even to birds as well. They were, indeed, planned with the idea that they should make possible the comparison of reaction-types or reactive

[6] Yerkes, Robert M., "Heredity of Savageness and Wildness in Rats," *Journal of Animal Behavior*, 1913, Vol. 3, p. 286.

tendencies in birds and mammals, and all these in turn with the tendencies displayed by human beings, either mature or immature, either normal or abnormal.

The two methods referred to are the quadruple choice method of Hamilton[7] and the multiple choice method of Yerkes. The Hamilton method places the subject in an experimental situation which may be reacted to in many different ways and with varying degrees of satisfactoriness or adequacy. The subject of the experiment is placed in a small room on one side of which there are four doors. From experience, he learns that he may escape by one of the doors, and only one, but which of the four to choose is his problem, for it is the plan of the experimenter to lock, in a given trial, the door through which the animal escaped in the previous trial and two others. Any one, then, of three doors may be unlocked in a given trial. The animal has absolutely no way of predicting which is unlocked. The general question is, then, how will a given type of organism or a given individual meet this situation? What habitual manner of meeting it will be acquired? How will the modes of reaction displayed by a child compare with those of an adult; of an ape, with those of a man?

The Yerkes method is similar in purpose to that of Hamilton, but it offers, in the opinion of the writer, somewhat more satisfactory opportunity to evaluate and compare results. It consists, essentially, in the presentation to the subject—bird or mammal; young or old, normal or abnormal—of a bank of twelve keys numbered from left to right, one to twelve. The subject is given to understand, verbally, or through actual experience with the apparatus, that pressing some one of the twelve keys will yield a certain desired result, such, for example, as the displaying of a picture, the presentation of food, the ringing of a bell. Success in the experiment means, simply, pressing the key which brings the desired result. The experimenter sees to it that in no two successive trials is the same key the one to be operated. He is, further, able to push back out of sight any number of keys and thus to present to the subject as few as one or as many as twelve.

Let us assume that in a given experiment the observer decides that the key the fourth from the left shall always be the "right" one. It then becomes the task of the subject of the experiment to suit his reactions to the number chosen by the experimenter. Only if he discovers the guiding idea of the experimenter can he succeed, trial after trial, in touching the right key at first. This method may be varied almost indefinitely in difficultness, and it may be made to elicit numerous reactive tendencies.

It is obvious that both of the methods thus briefly described above are attempts to elicit general reactive tendencies rather than to analyze reactions minutely and carefully. The methods are indeed intended to bring into clear light those modes of responding to a given situation which are characteristic of different types or conditions of living beings, and thus to furnish a basis for a profitable comparison of reactive tendencies.

I can not conclude this discussion without referring for a moment to a question which is frequently asked and which surely must have been in the minds of some of my hearers; namely, why is it that the behaviorist deals so often with the activities of the lower animals and so seldom with those of man? The question is pertinent, and the reasons, as I see them, are significant. They are chiefly two: in the first place, most lower animals are easily obtained,

[7] Hamilton, G. V., "A Study of Trial and Error Reactions in Mammals," *Journal of Animal Behavior*, 1911, Vol. 1, p. 33.

kept in confinement, bred and reared for experimental purposes; in the second place, many of them, in comparison with human beings, can be readily controlled throughout their lives and subjected to experimental conditions, in definite and measurable ways. Because, then, of the availability and controllability of lower animals, it is far easier and more satisfactory to make preliminary, exploratory and problems defining observations on their behavior rather than on that of man. It is further to be considered that the time of a human subject is worth infinitely more than that of an infra-human subject. On the whole, it seems clear that we work to advantage in the early stages of our science of behavior by letting the lower animals help us to the formulation of our problems and the development of our methods. Once fairly oriented and reasonably skilled in our technique, we may, with better effect, attack the problems of human behavior.

The above considerations lead to yet a further reflection concerning the relation of the study of the behavior of infra-human organisms to that of man. To the writer, it seems of preeminent importance that we prepare for rapid advance in our knowledge of human behavior by the systematic, thoroughgoing study of the behavior of some one or more of the anthropoid apes and of the higher monkeys. These creatures are nearest of kin to man, alike in structure and in behavior, and it is quite as surprising as it is unfortunate that we should know so little definitely concerning their mental characteristics or the facts and laws of their behavior. It may fairly be urged, I think, that no task comparable in importance with that of the systematic study of the instincts and intelligence of the apes lies before the behaviorist. Because of this strong conviction, I wish to present the following plan, which is quite as much in the interest of a study of man's behavior as of that of the anthropoid apes themselves.

It is proposed that a permanent station be established in some tropical country (Borneo and Jamaica would seem well worth considering) where, under favorable conditions, certain of the apes can be bred, reared and observed. Year after year, the staff of such a station should conduct systematic experiments with these animals and record observations of their behavior in their semi-wild state. There should be equally good opportunities for naturalistic and for experimental work, for the study of the development of forms of behavior, and of the relations of particular acts to definite environmental or other conditions. The value of such work would depend largely upon its continuance over a long period of time and upon the possibilities of breeding the animals and of observing the development of activities. To any one interested in the study of behavior, an elaborate program of research will at once present itself. It is wholly unnecessary, at this time, to enter into the details of such a plan. Suffice it to say that several biologists and psychologists, who have been consulted concerning it, enthusiastically approve of the proposal and earnestly hope that such a station may be established.

This plea for special and unique facilities for the systematic study of the apes is presented to you because upon students of genetics, eugenic investigators, and sociologists, quite as heavily as upon behaviorists and psychologists, must rest the responsibility of carrying out any such proposal. Moreover, I can urge the plan upon your consideration with enthusiasm because I fully believe that this apparently roundabout way to knowledge of the laws of our own behavior is in reality the most direct and desirable way. Certain it is that if

we neglect our present opportunities to study the anthropoids, our children's children will condemn us for neglecting invaluable opportunities. To-day, the chimpanzee, the orang-outang, the gibbon, as well as many species of monkey, are at hand for observation. A generation or two hence, many of the primates may be extinct. Should we not, in the interests of genetics, whether we be concerned primarily with problems of structure or of function, see to it that we adequately use, for the purpose of advancing human welfare, our present primate materials?

ROBERT M. YERKES
HARVARD UNIVERSITY

SWEATING THE SCIENTIST[1]

IN the four last numbers of *Science Progress* a notice has been inserted asking for information on the emoluments of scientific workers; and a considerable number of interesting replies have been received. They are not numerous enough to form a basis for any statistical investigation of the subject—which it is hoped may be attempted later on when more evidence has been collected; but the replies received, combined with information which may be otherwise obtained, suffice to prove the low scale of payment given throughout the British Empire for such work.

The term "scientific worker" includes, according to the notice, all salaried workers—that is, men of all grades, namely, research students, assistants, professors, directors of laboratories, and other fully paid workers, and also half-time and whole-time workers. The duties generally include teaching and the administrative charge of university departments, museums and special laboratories. The lowest scale of pay mentioned in the replies is £85 a year for half-time work; but it is notorious that a large number of such workers, especially in medical subjects, are paid nothing at all. The pay of junior posts (which are also sometimes unpaid) rises from about £120 to £200, £250 and, rarely, £300 a year. These are of course not so important as the upper scales of pay for full-time professorships and permanent appointments. For the latter, the highest pay mentioned in the replies amounts to £850 a year, with a small pension (Ceylon). The next highest are salaries of £750, both in South Africa, and one of £500 in Canada, with small pensions generally contributed to by the holders of the appointments. It is well known that many professorships in Britain yield £600 a year, with very small contributory pensions. In no cases do there appear to be any arrangements for family pensions in the event of the holders' death—such as are often provided in the public services; nor insurance against illness or accident. Notoriously, very few even of the highest posts receive a salary touching or exceeding £1,000 a year; and in nearly all cases the pensions are contributory and are of a very small amount—retirement being often compulsory at the age of 60 or 65 years. Progressive rises of pay are also seldom provided for; so that a man who obtains an appointment when comparatively young can seldom hope for any increase during the rest of his life. Lastly, payment is laid down at many universities according to a flat rate, or according to fixed endowments which depend upon the funds originally allotted—so that no provision is made for retaining specially good men. In some cases holders of fully paid appointments are able to increase their emoluments by outside work. Many medical professorships are quite unpaid.

The rates of pay must be judged by the locality in which they are given. Thus £750 in South Africa is worth very much less than that sum in Britain, the cost of living being perhaps twice as great. A correspondent from Canada remarks that a salary of £800 a year in England is equivalent only to about £600 a year there, and is not sufficient for a professor. "A member of a learned community," he says, "can not live in a back street like a laborer, and if he takes an unfurnished house

[1] An editorial article printed in the April number of *Science Progress in the Twentieth Century: A Quarterly Journal of Scientific Work and Thought*, edited by Sir Ronald Ross.